

# Discussion on Downtown Area Overpass Pedestrian System

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**(Abstract)** With the rapid urbanization and the increasing urban population in China, the congestion in big cities has become more serious. By investigation and analysis of current real situation, the paper proposes some conceiving thoughts for Overpass Pedestrian Systems, which is to relieve the traffic congestion in busy intersection in down town area. The system is designed to achieve effective separation of people and vehicles and improve the traffic conditions, and as a result, to enhance the quality of environment for urban residents.

**Keywords:** Urban Traffic; Overpass Pedestrian System; Busy Intersections

## 1. INTRODUCTION

China is in the process of the rapid development of the urbanization and the urban traffic congestion has been a serious problem in this process. Although every municipality has increased the municipal infrastructure construction, traffic jam is still a serious problem in every big cities such as Beijing, Shanghai, Guangzhou and Wuhan. Due to the increasing motor vehicles in cities and the aggregation of urban residents, traffic jam has seriously disturbed people's normal life.

In the urban traffic system, the pedestrian system is a supporting and supplementary system with high importance. A properly designed pedestrian system can effectively reduce the incidence of traffic accidents, improve the quality of public travel and the city image. Based on China's current rapid urbanization and high-density urban crowded state, we proposed the Overpass Pedestrian System to improve the traffic situation and realize the separation of people and vehicles. The system is built based on existing public facilities and could optimize the local environment, guide pedestrians' walking habits and create a smooth traffic safety.

## 2. THE ANALYSIS OF CURRENT PEDESTRIAN SYSTEM IN HEAVY TRAFFIC SITES

### 2.1. The Main Pedestrian Facilities in Heavy Traffic Sites

#### 1) Pedestrian crossings

Pedestrian crossings remain the most common current method in heavy traffic sites. Through the survey it is found that, pedestrian crossings are still very common in urban heavy traffic sites. These pictures indicate that the width of some trunk roads in the big cities in China, such as Shanghai or Wuhan are over 30 meters, while there are no traffic safety

island in the center line area. People and vehicles are controlled by the same traffic lights at these sites, so that people will keep a relative faster speed to cross the road. [Figure.1]



Figure1. A pedestrian crossings in Huangpu District ,Shanghai

#### 2) Pedestrian underpass



Figure2. The crossing with pedestrain underpass in Chang'an Rd,Beijing

Pedestrian underpass facilities have not been widely used in heavy traffic sites of most cities except large ones which already have subway systems [Figure.2]. On the contrary , in the cities without subway system, taking Wuhan as an example, only a few city squares in downtown and large wheel-type

intersections have been adopted the pedestrian underpass, and most of them are separately used and do not interact with the surrounding buildings and facilities to form a complete pedestrian system. Therefore, most of the current pedestrian underpasses are still not enough to effectively relieve traffic congestion.

### 3) Pedestrian bridge

Compared to the pedestrian underpass, the pedestrian bridge could effectively separate pedestrians and vehicles. Meanwhile, with its shorter construction cycle and lower cost than pedestrian underpass, Pedestrian bridges are necessary to be built in current urban pedestrian-intensive and heavy traffic areas. Some pedestrian bridges built in the pedestrian intensive intersections in downtown in big cities are dual functioned. Then can lead people walking into the buildings at the junctions while separate them from vehicles.[ Figure.3] These pedestrian bridge could be considered as the prototype of the Overpass Pedestrian System.



Figure3. A dual functional pedestrian bridge in Hanyang Rd, Wuhan



Figure4. A newly built pedestrian bridges over Luoyu Rd, Wuhan

From 2005, due to the increasingly serious traffic congestion, 18 new pedestrian bridges have been built in Wuhan at the end of 2010. And in early 2011, there are other 15 pedestrian bridges has been built and put into use. However, these new built pedestrian bridges cannot be regarded as Overpass Pedestrian System and they are only a temporary relief from the pressure of local traffic congestion. [ Figure.4] But it is predictable that separating the people and vehicles by the way of building overpasses will become the trend.

## 2.2. The Suitability of Current Pedestrian Facilities

### 1) Walking convenience

In general, the pedestrian crossings are set at the intersections of the roads, but the bus stations are set normally 50 meters or

more away from the intersection. This causes a contradiction, if people are waiting for the traffic light at the zebra crossing and walk through the road obeying the traffic rules, they may miss the coming bus, nevertheless they can catch the bus by some dangerous way without walking along the specified zebra crossings. [Figure.5] The bright yellow line in Figure.5 indicates the distance of the path from one bus station to the other one on the other side of the road, which is over 300 meters. The traffic facilities at the intersections ensure the smooth passage of vehicles but increase the inconveniences of pedestrian traffic.

As for the pedestrian bridges, because of limited construction technique and cost, their convenience of walking of the are not prominent at present.



Figure5. The walking distance for people between two bus station

### 2) Walking comfort level



Figure6. The walking distance for people between two bus station

Generally, the pedestrian overpass constitutes the major part of the existing aerial pedestrian facilities. Among the existing pedestrian bridges in Wuhan, the vast majority have not been installed the roof and are lack of the function of shading against sun and rain. In the contrast, because of the benefits motivation, advertising plates are usually set on the barriers. These advertising plates not only affect the pedestrian perspective but also reduce pedestrian a potential demand – viewing. In addition, the lack of barrier free design leads to the difficulties of the crossing of non-motorized vehicles.

Here is the Pedestrians cross an overhead bridge at night in



Central Hong Kong [Figure.6]<sup>①</sup>, the design of which is more comfortable than what mentioned above.

### 3) Walking reachability

Current pedestrian facilities, whether pedestrian underpasses or pedestrian overpasses, only consider the main purpose of crossing the road and rarely take into account the connections to surrounding commercial buildings. Especially in recent years, new pedestrian overpasses only achieve a single separation function. Using these facilities, as a pedestrian, in most cases will increase the walking distance but do not receive appropriate compensation. Without an additional accessibility, and even more cumbersome than crossing on the ground directly, pedestrians' subjective use of such facilities will be reduced potentially. [Figure.7]<sup>②</sup> below shows a multi-way pedestrian overpass in Hamburg, Germany, which has good walking reach ability.



Figure7. a multi-way pedestrian overpass in Hamburg

### 4) Pedestrian Safety

Among the current walking way of the city, mixed people and vehicles hold greatest security risks mainly for the following two reasons: a. Right turn is not controlled by red light and usually conflict with pedestrians; b. The urban trunk road junctions, are mostly two-way six lanes and road width exceed 30 meters including bicycle lanes. According to "Urban Traffic Planning and Design Standards", the pedestrian walking speed is 1.1 m/s. However, to protect the priority of vehicles in some of the road junctions, the green light for the pedestrian is too short by the length without taking vulnerable groups into account, forcing the pedestrian walking speed is greater than 3 m/s and potentially increase the risk.

Pedestrian bridges and pedestrian underpass are much safer than pedestrian crossings on the ground. But some pedestrian bridges are lack of maintenance, some bridges' are overloaded, or some have the deformation of the deck. All mentioned above can result in some potential dangers.

## 2.3. The Alleviation Effect of Current Pedestrian Facilities on the Traffic Congestion

<sup>①</sup> Figure source:

<http://knowledge.allianz.com/?1881/walkability-audit-interview-urban-transporation-walkable-cities-key-to-mobility-of-elderly>

<sup>②</sup> Figure source: <http://langintro.com/hamburg5/17jun08.html>

Now, the traffic flow in some traffic hubs in metropolis, such as railway stations, long - distance bus station, larger public transit transfer site, or commercial areas is very large at the rush our, which always result in traffic congestion at these hubs. Worse, the traffic congestion will affect in a greater scope beyond these traffic hubs.

The observation of the pedestrian bridges indicates that in these heavy traffic locations, although the traffic situation is better at the location where the pedestrian bridges are built, the existing ones can not form the efficient the pedestrian-and-vehicle dividing system, and the advantage of pedestrian bridge is not obvious.

## 3. THE IMPLEMENTATION CONCEPT OF OVERPASS PEDESTRIAN SYSTEM IN THE FUTURE CITY

### 3.1. General Principles of the Constructions

Construction of the Overpass Pedestrian System is a systematic construction, rather than the isolated construction of certain facilities. Therefore, if conditions allow, buildings, roads, environment and public facilities need to be uniformly planned in selected areas of construction, in order to achieve a systematic structure.

### 3.2. Site Selection

Focusing on relieving traffic congestion in heavy traffic sections, the Overpass Pedestrian System discussed in this paper will be mainly constructed at the junction along the main city roads, dense commercial network and the traffic hub. The size and manner of construction will take the existing road width, existing facilities, surrounding buildings and areas features, walking features of specific areas into account..

### 3.3. Methods of the Construction

Since the growth of urban space is a process covering a large time span, so there two kind of major buildings including existing buildings and buildings to be built in urban area. But construction of the Overpass Pedestrian System is inseparable from the building, so the system should be built in combination with the existing conditions in their environment, taking different approaches depending on existing buildings and buildings to be built.

#### 1) Overall planning for the building to be constructed

In this conception, the design of the Overpass Pedestrian System should be combined with the designs of buildings to be constructed at the heavy traffic intersections. The most basic point is that the ground floor level of this type of buildings will be designed to be elevated and used for the parking of motor vehicles and bicycles, so that pedestrians can be transported into the underground mass transit system, Overpass Pedestrian System or related functional places from the ground floor through the vertical lift, or automatic sidewalks. It not only saves the parking area, but also promotes separation of pedestrian and vehicle. In the

large-scale commercial or transportation hub, it is necessary to bring in a larger scale systematic planning of pedestrian system and unified design of buildings within the region to achieve the aimed effect.

#### 2) Construction adhering to existing building

In addition to the new construction, the Overpass Pedestrian System could be built by the additional construction considering the existing environment. Compared with current pedestrian bridges, additional construction will focus more on the connectivity with the surrounding. The Overpass Pedestrian System can be set up above the current foot sidewalk network using lightweight sturdy material, and the ground part can be used for parking motor vehicles and bicycles instead. People could step into the pedestrian system through lifting devices, and enter destinations

### 3.4. Components of the System

The Overpass Pedestrian System proposed in this paper can be divided into switching and connecting part, passage part, functional parts and auxiliary parts in composition.

#### 1) Switching and connecting part

Switching and connecting part is the transition areas between the pedestrian system and the parking area of non-walking traffic tools. The primary function of this part and instructions from the ease of transportation or to enter the pedestrian from which it is a semi-enclosed area, above the location of non-pedestrian, but also access to the area, and then into the target channel.

From the subdivision point of view, this part can be identified with two types. One is designed for joint the public transit system and the other is for the parking lots. When people are in the intricate urban public transport system, they always need to transfer from different mass transits such as bus, subway and light rail. In the concept of Overpass Pedestrian System, the joint areas between people and public transport system should be clearly oriented and orderly separated.

The type of connecting with the parking lots ensure people entering the Overpass Pedestrian System by walking and mechanical devices. For instance, pedestrians can be transported into the mass transit system or Overpass Pedestrian System through the vertical lift, or automatic sidewalk.

#### 2) Transportation part

Transportation part can be regarded as the upgraded pedestrian overpass, while it is more complex and multi-functioned. It links other parts of this system and the buildings or facilities at the traffic intersections on both sides of the road. Transportation part is the major structure of the Overpass Pedestrian System which insures the separation of pedestrians and vehicles. Compare to existing pedestrian overpasses, the efficacy and morphology of which will be more abundant..

#### 3) Service facility part

Service facility part is the auxiliary functions of Overpass Pedestrian System besides the separation of people and

vehicles. The main aim of the part is to increase pedestrian walking comfort, diversify walking function and improve efficiency. In order to coincide people's walking habits and help them to enjoy the walking experience in the system.

In some nodes of the Overpass Pedestrian System especially in the transport part, public service facilities including retail outlets, network query machines, ATM machines are necessary. Further, the landscape viewing points and rest area will be set dispersedly and well-organized. With the Service facility part, People can also achieve other needs besides walking when they are passing through the Overpass Pedestrian System. As long as the part is reasonable designed and delightful, it will be gradually accepted and even relied on by people who are always under the pressure of modern metropolis lives.

## 4. THE ANTICIPATED BENEFITS OF THE OVERPASS PEDESTRIAN SYSTEM

### 4.1. Mitigating the Traffic Congestion

Ideally, the separation of people and vehicles will be completely realized when the Overpass Pedestrian System has been appropriately established. Traffic lights for facilitating pedestrians will be no longer set up to improve the efficiency of vehicles in vehicle lanes of busy sections. With the passing efficiency of the main road increases, local traffic pressure will be naturally alleviated.

### 4.2. Increasing the Walking Comfort Level

The Overpass Pedestrian System in this paper is a multi-functioned system, and the design of which is humanity oriented. It will not only improve the separation of people and vehicles, but also concerns about the feelings and behavior of vulnerable groups in urban traffic. The Overpass Pedestrian System is not just a simple association of channels, but makes the convergence of traffic to be "of pleasant" after detailed research and analysis. By means of enriching the additional public service features of the system such as resting, viewing, access to information, etc., with its reasonable and delightful designed, it will be gradually accepted and even relied on by people who are always under the pressure of modern metropolis lives. The habit of using the air pedestrian system by people will be gradually formed, and they will enjoy more comfort of walking than ever before.

### 4.3. Improving the Commercial Value

Although the main purpose of constructing the Overpass Pedestrian System is to alleviate the traffic jam in some intersections, its profit will be more than that. For this system will mostly be located in the busy downtown areas, and connect a quantity of different business and service substance together, to maintain the efficiency of the system and stimulate economy development of the areas, many new service demands will be required, some of which can be properly commercialized. Furthermore, as the Overpass Pedestrian System inherently needs, there will be new

services in order to content its functions, which can also increase commercial benefit of the area. So, the estimate of economical growth of these area is optimistic.

## 5. CONCLUSIONS

The Overpass Pedestrian System proposed in this paper is a part of the urban road traffic system and a necessary complementary measure for alleviating tensions in urban traffic. Such concept may also encounter the following problems in the specific implementation, such as whether it is suitable for the current urban environment, whether it can guide the walking habit of pedestrians, whether it can resolve the security of different spaces, and also issues concerning the main body of the investment and income distribution which are related to economic aspects. But these potential problems will be a properly solved by drawing on existing experience at home and abroad, and attracting capital investment depending on relevant state policies, which will also be deeply studied in the future.

In general, the effective establishment of the Overpass Pedestrian System can regulate pedestrian walking habits invisibly, promotes the efficient use of roads and reduces the risk of accidents caused ground traffic congestion

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